REMARKS

I. Introduction

By the present Amendment, claims 1 and 26 have been amended. No claims have been added or cancelled. Accordingly, claims 1-6 and 26-29 remain pending in the application. Claims 1 and 26 are independent.

II. Office Action Summary

In the Office Action of February 20, 2008, the Specification was objected to because the Title of the Invention was not descriptive. Claims 1, 4, 5, 26, and 27 were rejected under 35 USC §102(b) as being anticipated by Ko et al. ("Ko"). Claim 2 was rejected under 35 USC §103(a) as being unpatentable over Ko in view of Henry et al. ("Henry"). Claim 3 was rejected under 35 USC §103(a) as being unpatentable over Ko in view of U.S. Patent No. 6,801,650 issued to Kikuchi et al. ("Kikuchi"). Claims 6, 28, and 29 were rejected under 35 USC §103(a) as being unpatentable over Ko in view of Xu et al. ("Xu"). These rejections are respectfully traversed.

III. Objections to the Specification

The Specification was objected to because the Title of the Invention was not descriptive. The Office Action further required that a new title be provided that is clearly indicative of the invention to which the claims are directed.

By the present Amendment, Applicants have amended the title of the invention to recite "METHOD AND APPARATUS FOR CLASSIFYING DEFECTS USING MULTIPLE CLASSIFICATION MODULES." Applicants respectfully submit

that the present title is clearly indicative to the invention to which the claims are directed. Withdrawal of this objection is therefore respectfully requested.

IV. Rejections under 35 USC §102

Claims 1, 4, 5, 26, and 27 were rejected under 35 USC §102(b) as being anticipated by Ko. Regarding this rejection, the Office Action indicates that Ko discloses a method for classifying defects that comprises all the features of the claimed invention, including classifying the defect in accordance with the extracted characteristics, and based on a rule-based classification and a learning type classification; calculating a set of first likelihoods of the defect belonging to each of a plurality of defect classes of the rule-based classification; calculating a set of second likelihoods of the defect belonging to each of a plurality of defect classes of the learning type classification. In particular, the Office Action indicates that Ko discloses calculating a third set of likelihoods of the defects belonging to each of the defect classes of the learning type classification by use of the first and second likelihoods; and classifying the defect based on the third likelihoods. Applicants respectfully disagree.

By the present Amendment, Applicants have revised the language of the claims to better clarify the manner in which the third set of likelihoods is calculated. As amended, independent claim 1 defines a method for classifying defects that comprises:

> obtaining an image of a defect on a sample;
>
> extracting a characteristic of the defect from the image;
>
> classifying the defect in accordance with the extracted characteristic, and based on a rule-based classification and a learning type classification;
>
> calculating a set of first likelihoods of the defect belonging to

each of a plurality of defect classes of the rule-based classification, by use of the extracted characteristic;

calculating a set of second likelihoods of the defect belonging to each of a plurality of defect classes of the learning type classification, by use of the extracted characteristic;

calculating a third set of likelihoods of the defect belonging to each of the defect classes of the learning type classification, by calculating a weighted average of the first and second likelihoods; and

classifying the defect by use of the third likelihoods.

As set forth in independent claim 1, an image of a defect on a sample is first obtained, and a characteristic of the defect is extracted from the image. Next, the defect is classified in accordance with the extracted characteristic, and based on a rule-based classification and a learning type classification. A set of first likelihoods that the defect belongs to each of the plurality of defect classes of the rule-based classification is calculated using the extracted characteristic. A set of second likelihoods is calculated that the defect belongs to each of a plurality of defect classes of the learning type classification using the extracted values. According to independent claim 1, a set of third likelihoods of the defect belonging to each of the defect classes of the learning type classification is calculated by determining a weighted average of the first and second likelihoods. Finally, the defect is classified using the third likelihoods. As discussed in the Specification, the present invention calculates a combination of likelihood by plural models and a weighted average according to likeness of the classification model. This allows provision of an inherent and optimum classification model to be automatically provided in response to a defect classification request that can differ depending on each user. See paragraphs [0106] to [0114] of the published application.

The Office Action alleges that Ko discloses all the features recited in independent claim 1. Applicants' review of Ko, however, has not revealed the same type of calculation for the third set of likelihoods as now recited in the claimed invention. According to Ko, the combination likelihood is determined by combining a fuzzy logic scheme into an LVQ neural network in order to reflect human experience and pre-knowledge for judging criteria to classify the complex solder joints. Therefore, the classification scheme has two hierarchically organized modules consisting of a neural network clustering module and a fuzzy rule-based classification module. See page 94, column 1, second paragraph (i.e., lines 27-33). Ko does not appear to provide any disclosure for calculating a combination likelihood that utilizes the weighted average of two sets of likelihoods. More particularly, Ko fails to provide any disclosure for features recited in independent claim 1 such as:

> calculating a set of first likelihoods of the defect belonging to each of a plurality of defect classes of the rule-based classification, by use of the extracted characteristic;
>
> calculating a set of second likelihoods of the defect belonging to each of a plurality of defect classes of the learning type classification, by use of the extracted characteristic;
>
> calculating a third set of likelihoods of the defect belonging to each of the defect classes of the learning type classification, by calculating a weighted average of the first and second likelihoods; and
>
> classifying the defect by use of the third likelihoods.

It is therefore respectfully submitted that independent claim 1 is allowable over the art of record.

Claims 2-6 depend from independent claim 1, and are therefore believed allowable for at least the reasons set forth above with respect to independent

claim 1. In addition, these claims each introduce novel elements that independently render them patentable over the art of record.

As amended, independent claim 26 defines an apparatus for classifying defects that comprises:

> imaging means for obtaining an image of a defect on a sample;
>
> means for extracting a characteristic of the defect from the image;
>
> means for classifying the defect in accordance with the extracted characteristic, and based on a rule-based classification and a learning type classification, and
>
> a display for displaying the image of the defect and the classification result on a screen;
>
> wherein said classifying means comprises:
>
> a rule-based classification apparatus for calculating a set of first likelihoods of the defect belonging to each of plurality of rule classes by use of the characteristics of the defect,
>
> a learning type classification apparatus for calculating a set of second likelihoods of the defect belonging to each of a plurality of defect classes by use of the characteristic of the defect, and
>
> a classification model for calculating a set of third likelihoods of the defect belonging to each of said defect classes, by calculating a weighted average of the first and second likelihoods.

According to at least some of the features of independent claim 26, a rule-based classification apparatus is used to calculate a set of first likelihoods that the defect belongs to each of a plurality of rule classes. A learning type classification apparatus is used to calculate a set of second likelihoods that the defect belongs to each of the plurality of defect classes. Furthermore, a classification module calculates a set of third likelihoods that the defect belongs to each of the defect classes by calculating a weighted average of the first and second likelihoods. As previously discussed with respect to independent claim 1, Ko does not appear to

provide any disclosure or suggestion for such features. In particular, Ko utilizes a hierarchical arrangement having two modules, namely a neural network clustering module and a fuzzy rule-based classification module, which differs from the claimed invention.

It is therefore respectfully submitted that independent claim 26 is allowable over the art of record.

Claims 27-29 depend from independent claim 26, and are therefore believed allowable for at least the reasons set forth above with respect to independent claim 26. In addition, these claims each introduce novel elements that independently render them patentable over the art of record.

V. Rejections under 35 USC §103

Claims 2, 3, 6, 28, and 29 were rejected under 35 USC §103(a) as being unpatentable over Ko either alone or in combination with various secondary references.

As previously discussed, however, Ko fails to disclose certain features now recited in independent claims 1 and 26 (from which these claims depend). Additionally, the features that are not disclosed by Ko are not disclosed or suggested by either Ko or the secondary references. Consequently, the various combinations of references used to reject these claims will necessarily fail to provide any disclosure or suggestion for all of the features recited in these claims.

Thus, in addition to being patentable based on their dependence from independent claims 1 and 26, these claims are further believed allowable over the art of record.

VI. Conclusion

For the reasons stated above, it is respectfully submitted that all of the pending claims are now in condition for allowance. Therefore, the issuance of a Notice of Allowance is believed in order, and courteously solicited.

If the Examiner believes that there are any matters which can be resolved by way of either a personal or telephone interview, the Examiner is invited to contact Applicants' undersigned attorney at the number indicated below.

AUTHORIZATION

Applicants request any shortage or excess in fees in connection with the filing of this paper, including extension of time fees, and for which no other form of payment is offered, be charged or credited to Deposit Account No. 01-2135 (Case: 500.43701X00).

Respectfully submitted,
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